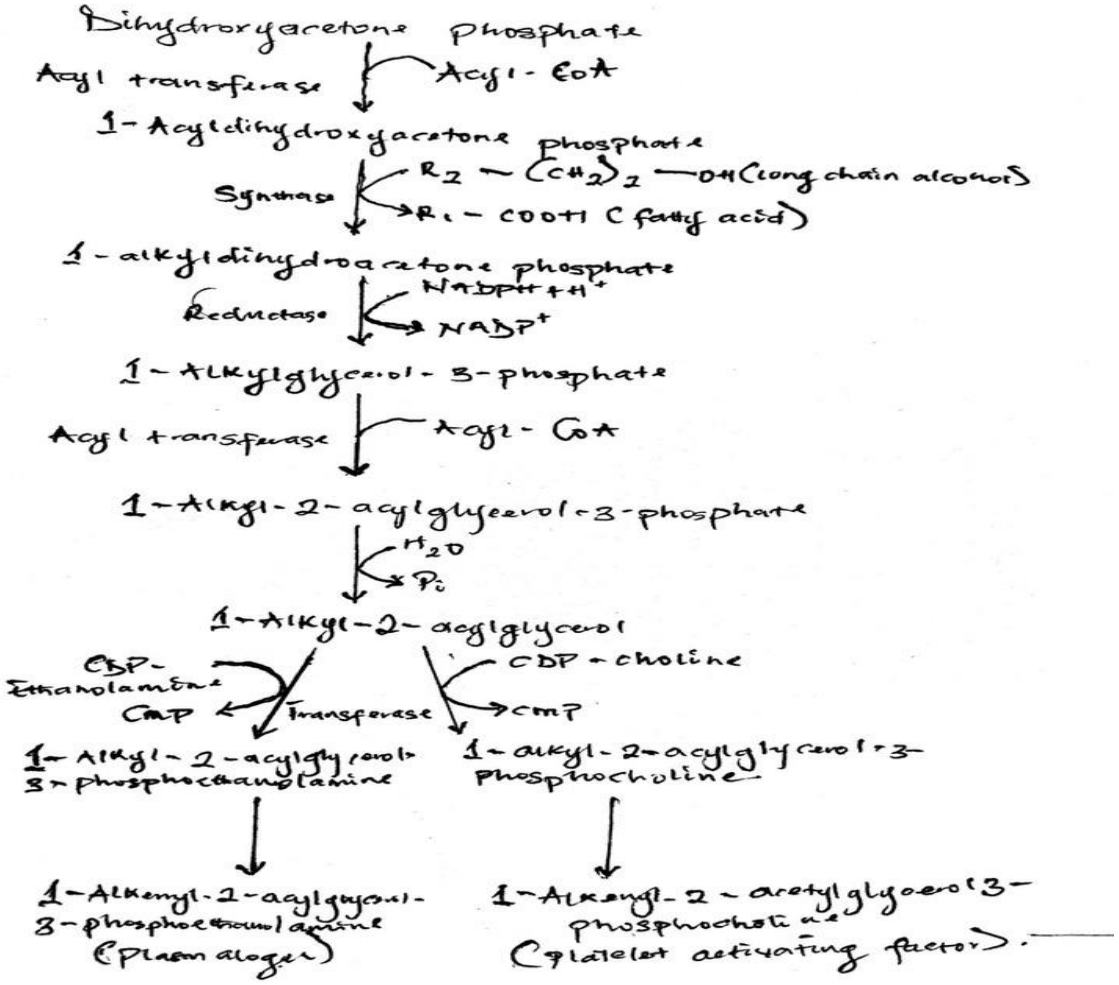
ODOMENE JUSTICE

17/SCI03/006

BCH302

1. Describe biosynthesis of plasmalogens as it occurs in peroxisomes.

Plasmalogen biosynthesis begins in the peroxisomes, where the integral membrane protein dihydroxyacetone phosphate acyltransferase (DHAPAT) catalyzes the esterification of the free hydroxyl group of dihydroxyacetone phosphate (DHAP) with a molecule any of long chain acyl CoA. Next, alkyl-DHAP synthase, a peroxisomal enzyme associated with DHAPAT, replaces the fatty acid on the DHAP with a long chain fatty alcohol. The third step of plasmalogen biosynthesis is catalyzed by the enzyme acyl/alkyl-DHAP reductase, which is found in the membrane of both the peroxisome and endoplasmic reticulum (ER). Acyl/alkyl-DHAP reductase uses NADPH as a cofactor to reduce the ketone of the 1-alkyl-DHAP using a classical hydride transfer mechanism. The remainder of plasmalogen synthesis occurs using enzymes in the ER. Lysophosphatidate acyltransferases (LPA-ATs) transfer the acyl component of a polyunsaturated acyl-CoA to the the 1-alkyl-DHAP, creating a 1-alkyl-2-acylglycerol 3-phosphate. The phosphate is then removed by lipid phosphate phosphohydrolas I (PAP-I), and the head group is attached by a choline/etanolaminephosphotransferase.



2. Several specific phospholipases are involved in reactions of phosphoglyceride degradtion. With the aid of a named phosphoglyceride (structure), show and explain the site of degradation of 5 phospholipases.

i. **Phospholipase-A1:** Remove the fatty acyl group on C1 of the glycerol moeity.

ii. **Phospholipase-A2:** Catalyzes the hydrolysis of the ester bond of glycerophospholipids to form a free fatty acid and lysophospholipid, which is attacked by lysophospholipase by removing the remaining 1-acyl group.

iii. **Phospholipase-B:** Hydrolyzes both acyl groups on C1 and C2.

iv. **Phospholipase-C:** Cleaves the bond between phosphate and glycerol of phospholipids.

v. **Phospholipase-B:** Cleaves the bond berween the phosphate and the nitrogen base.

3. Explain biosynthesis and degradation of glycolipids.

Biosynthesis of glycolipids: Cerebroside is the simplest glycosphingolipid. In a cerebroside, glucose or galactose is linked to the terminal hydroxyl group of ceramide to form glucocerebroside or galactocerebroside. Galactocerebroside is a major lipid of myelin, whereas glucocerebroside is the major glycolipid of extraneural tissues and a precursor of most of most of the more complex glycolipids.

- Ceramide reacts with UDP-glucose or UDP-galactose to form glucocerebroside or galactocerebroside respectively.
- Gangliosides are the major complex glycolipids, contain a branched chain oligosaccharide of as many as 7 sugar residues.
- Gangliosides are produced from ceramide by the stepwise addition of activated sugar, e.g UDP-glucose, UDP-galactose and sialic acid usually N-acetylneuraminic acid(NANA).

Degradation of Glycolipids: The glucocerebrosides and galactocerebrosides are hydrolyzed by lysosomal enzymes; beta-galactocerebrosidase and beta-glucocerebrosidase respectively to ceramide and hexose residues. The ceramide formed is further cleaved by the another lysosomal enzyme ceramidase to sphingosin and FFA. The different gangliosides are degraded by a set of lysosomal enzymes; beta-glucosidase, beta-hexasominidase, beta-galactosidase, neuramidase.